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XXI. ON THE VALLEY OF THE SETLEJ RIVER, IN THE HIMALAYA MOUNTAINS, from the Journal of CAPTAIN A. GERARD, with Remarks by HENRY THOMAS COLEBROOKE, Esq., Dir. R.A.S.

Read December 3, 1825.

CAPT. A. GERARD, from whose letters on a survey of the middle valley of the *Setlej*, in the year 1818, a brief sketch of the geology of that part of the *Himálaya* was prepared, which has been inserted in the Geological Transactions (1st vol., New Series), has since continued to explore the same interesting portion of the great Indian chain of mountains. A short narrative of a visit to the same quarter, in 1820, was communicated to the Royal Society of Edinburgh, and is published in the 10th volume of the Edinburgh Philosophical Journal, (page 295.) In the subsequent year (1821) Capt. A. Gerard, with his brother, Mr. J. G. Gerard, more fully explored the same valley, to complete a geographical survey of it. Their diary, and the geological specimens collected by them, have, at their request, been freely communicated to me by the East-India Company, with the liberal permission of retaining a duplicate set of the specimens. This I accordingly have had the satisfaction of presenting to the Geological Society. But, as the diary contains particulars unconnected with geology, yet not devoid of interest in a more general view, I now offer to the notice of the Royal Asiatic Society a summary of it, interspersed with remarks, and including extracts of the more important passages.

The diary commences on the 6th of June 1821, at *Ról*, near the foot of the *Shátúl* pass, where the previous survey of the same tract in 1818 terminated. *Ról* is a small district in *Chúará*, one of the larger divisions of *Baséhar*. It contains five villages, situated upon the south-western declivity of the mountainous range. These villages vary in altitude, from 9,000 to 9,400 feet above the level of the sea. *Ról* itself is 9,350 feet. It is the highest inhabited land without the *Himálaya*. The crops are wheat, barley (*H. hexastychon*), Siberian barley (*H. cæleste*), called by the mountaineers *U'ä*, *Polygonum?* (*phápar*) and pease: they just reach to

10,000 feet. The wheat seldom ripens; and, when the rains fall early in June, most of the grains are cut green.

The travellers proceeded from *Ról* through a fine wood of oak, yew, pine, rhododendron, and horse-chestnut, with some juniper, and long thin bambus,* to *Búchkálghat*, just overtopping the forest at the elevation of 11,800 feet.

They passed by an extremely difficult and tiresome way, amongst piles of loose stones, which seemed to have been but lately precipitated from above, to *Rëúni*, a halting-place for travellers, on the bank of a rivulet, at an elevation of 11,750 feet. In the vicinity were stunted birches, dwarf oaks, pines, and juniper, and two species of rhododendron; one, as called by the natives, *Tálsár*. Flowers abounded, such as thyme and cowslips. The soil is a rich moist black turf, not unlike peat.

The *Shátúl* pass had not been traversed since the month of September, 1820, when Mr. James G. Gerard effected the passage with much difficulty and danger, and lost two of his servants, who were frozen to death at mid-day. It was attended with less peril at this early season: Messrs. Gerard were the first persons who visited it in 1821. Having before travelled the ordinary road through the pass, they determined to strike directly across the ridge, which they accomplished. Its elevation was found by barometric measurement to be 15,556 feet above the sea,† confirming a similar measurement in the preceding year, which made it but two feet less.

The rocks were chiefly mica slate, and gneiss. In the ascent they had noticed a huge granitic rock, in the chilly recess of which they rested; and their route had led them in some places over heaps of angular fragments of gneiss, granite, quartz, and felspar, jumbled together in wild disorder, where every step was dangerous.

* Throughout the diary, with rare exceptions, I have retained Captain Gerard's names of plants. Probably the English names are not always rightly applied; or, if right generically, the species must be for the most part different. They will be corrected in an appendix, so far as I may be in possession of sufficient information for the purpose, before the present volume is closed.—H.T.C.

† The heights of most remarkable places are calculated from corresponding observations of the barometer at *Súbáthú*: the exact number of feet is in such instances noted. Others were obtained by differences, and they are put down to the nearest fifty feet.

To the east and south-east was seen a low part of the Himálayan range. Its altitude is much less than that of *Shátúl*; but it is rendered impassable by a perpendicular wall of gneiss, that forms an impracticable barrier for several miles.

The snow became more frequent as they ascended, till they attained the crest of a ridge, at the elevation of 13,450 feet, where it is continuous at that early season. A month later, it would be dissolved. Upon the snow, at the greater height of *Shátúl*, were many insects like mosquitoes: at first they were torpid; but sunshine revived them. Some birds were seen, resembling ravens. Mosses were found on the few rocks.

The travellers halted for the night at *Kaniján*, under the shade of a large rock, at the height of 13,400 feet, whence the steep ascent of the pass begins. There were plenty of flowers where the snow had melted, but no bushes. The firewood was brought from the last camp.

From this spot the ascent seemed appalling. The crest was nearly 2,200 feet higher. Here and there a rock projected its black head; all else was a dreary solitude of unfathomable snow, aching to the sight, and without trace of a path.

The travellers found the snow, which was soft at mid-day, afford good footing, and reached the summit with less fatigue than they anticipated. They remained the night and following day at the crest of the pass, and suffered much from head-ache and difficulty of breathing, usually experienced at such elevated positions. It snowed in the evening. The temperature did not rise above 41° at noon: it was 24° and 26° at sunrise (9th and 10th of June).

On the subsequent day, they descended upon the same side, and proceeded along the dell of the *Andréti*, a branch of the *Pabar* river, rising near *Shátúl*, and halted on the bank of a rivulet called *Dínggrú*, at an elevation of 12,800 feet, just above the limit of the forest. The lowest point in the dell was 11,100 feet. Leeks were gathered at the height of 12,000 feet. The ground was here a rich sward, cut up in grooves by a large kind of field-rat, without a tail.*

Capt. Gerard and his brother continued to explore the glens and valleys of the tributary streams of the *Pabar* river; in particular the valley of the

* *Spalax* (*Mus typhlus*)?

Sípon river, and that of the *Pabar* itself, visiting the confluence of these rivers, the summit of the ridge which divides them, and the sources of both rivers.

The Himálayan glens for the most part run almost perpendicular to the range, or from N.N.E. and N.E. to S.S.W. and S.W. The face exposed to the N.W. is invariably rugged; and the opposite one, facing the S.E., is shelving. The roads to the most frequented passes lie upon the gentle acclivity: the difference of the elevation of forest on either side is remarkable. On the declivity towards the N.W., which, as before observed, is the most abrupt, the trees rise several hundred feet higher than those upon the opposite face, which has a more gentle slope; and in some instances, the difference exceeds 1,000 feet. The general height of the forest on the southern face of the *Himálaya*, is about 11,800 to 12,000 feet above the sea. Oaks and pines reach that elevation; birches extend a few feet higher. Descending from the pass of *Bandáján*, the level of the highest juniper was observed 13,300 feet.

From *Shéarghal*, at an elevation of 13,720 feet (which the travellers reached by a very steep path, crossing several snow-beds, where it was necessary to cut steps with a hatchet, and passing among gigantic oblong masses of mica slate, disengaged from the impending crags), the prospect is very extensive. Towards the plains appear the *Chúr* mountains, 12,000 feet (one measured barometrically is 12,143 feet); to the S.E., snowy summits of immense altitude, in the direction of *Yamunávatári*, rising one above another in majestic disorder, and presenting mountains of eternal snow; and beyond the source of the *Pabar*, one of the huge *Raldang* peaks, above 21,000 feet. Across the *Pabar*, is the *Chashíl* range, through which are several passes, 13,000 to 14,000 feet high.

The travellers passed through *Tangno*, which gives name to a small district, comprehending five villages. Abundance of thyme, strawberries, nettles, thistles, and other European plants, was noticed. The houses are shaded by horse-chestnuts, walnuts, and apricots. The elevation of the place is 8,800 feet.

Unable to procure guides to the *Súndrú* pass, Messrs. Gerard proceeded to *Janglig*, a place already visited in 1820. Its height is 9,200 feet: the highest habitation, 9,400 feet.

The *Yúsú* pass, at the head of the *Sípon* river, which is called *Yúsú*, in its upper course, above *Bandáján*, is 15,877 feet high. The dell, between

this and *Bandáján* pass (14,854 feet above the sea), is shut in towards the N.E. by snow-capped mountains, upwards of 17,000 feet high, amongst which the river has its source. The rocks at *Bandáján*, and on the bank of the river, where the travellers encamped at the height of 13,650 feet, were gneiss; and the adjoining mountains the same, and clay slate. The descent was over broken slate, from *Bandáján*.

The ascent of *Yúsú* pass was extremely fatiguing: Messrs. Gerard describe themselves as having been so exhausted at first, that they rested every hundred yards; and, had they not been ashamed, before so many people, some of whom they had induced to accompany them after much intreaty, they would have turned back.

At the summit of the pass, there is a plain covered with snow for 400 or 500 yards. The ground slopes suddenly to the valley of the *Setlej*: the peaks on each side seemed about 800 feet higher.

The *Yúsú* river is divided into several streams, all of which, but the principal one, were crossed by arches of snow. The largest, which was forded, was forty feet broad, and six inches deep: the bed full of pebbles, and the margin snow-washed by the stream. With the exception of that principal channel of the river, and some openings partially disclosing the smaller branches, the rest is a bed of snow six or eight inches thick.

The glen becomes more and more contracted, till at last it is bounded by mural rocks of granite, with the *Yúsú* forcing its passage between them in impenetrable obscurity, under immense heaps of indestructible ice, running in ridges, and studded with mounds of snow.

The source of the *Pabar* is in a lake, called *Cháramãĩ*, above a mile in circuit, whence the river rushes forth over a perpendicular rock, forming a fine cascade. Above it are enormous banks of snow, 80 or 100 feet in thickness, which have cracked and partly fallen outwards into the lake. Just beyond them are three high passes, *Níbrang*, *Gunás*, and *Ghúsúl*, which lead over the summit of the range, into the valley of the *Baspá* river, and are very steep. The travellers were unable to persuade the guides to conduct them over either of these passes; but subsequently visited them from the other side.

The *Búrendo*, or *Bruäng* pass, near the *Pabar*, was again visited. It had been measured barometrically in 1818: the measurement now taken exceeded the former one (which was 15,095 feet) by 153 feet. To that extent the barometric measurements must be considered uncertain. They

halted two days on the summit of the pass; and, as is usual at so great elevations, were troubled with head-aches and difficulty of respiration. The nights were calm; but the solemn stillness was now and then interrupted by the crash of falling rocks.

They descended into the valley of the *Baspá*; sliding down the declivity of a snow-bed, by seating themselves upon a blanket on the snow. This mode is invariably practised by the mountaineers, where there are no rocks nor precipices. They had then a dreadfully dangerous footpath, along the rugged sides of the dell: it crossed many snow-beds, inclined at an angle of 30° or more; which delayed them much, as they had to cut steps in the snow.

The *Baspá* is a noble river, running through a romantic valley, which, the people have a vague tradition, was formerly a lake, and it has every appearance of it. The valley is bounded, on each side, by abrupt ridges of the *Himálaya*, which present a great deal of bare rock.

The travellers advanced to the confluence of the *Baspá* and *Bakti* rivers; examined the valley of the latter, and reached the confluence of the *Bakti* and *Nalgún* rivers, proceeding along the ridge, which is traversed by several passes before-mentioned, all of which they now visited, *viz.* *Níbrang*, 16,035 feet high; *Gúnás*, 16,026 feet; and *Ghúsúl*, 15,851 feet; as also *Rúpín*, 15,480 feet.

At *Núrá*, a halting-place, where there are good caves for shelter, at the elevation of 13,150 feet, and at *Dónisón*, where they halted the following evening, at the height of 14,200 feet, there was, through the night, a continued crash of falling rocks, on the rugged side of the dell. The species of rhododendron called by the natives *Tálsár*, was observed in the vicinity of *Dónisón*, at its level.

The *Nalgún* pass, the lowest pass through the *Himálaya* which had been yet visited, is 14,891 feet above the sea. From this pass they descended to the confluence of the *Nalgún* and *Bakti* rivers, and thence proceeded along the *Bakti*, and across the *Baspá* river, to *Sangla*, where they halted several days (23d to 29th of June), and whence they despatched their collection of plants and geological specimens; but the paper envelopes of the latter were rendered illegible, and the whole of the former destroyed, by the heavy rain which overtook the despatch, in the following month.

Messrs. Gerard, resuming their journey, ascended the valley of the *Baspá* to *Chéthkúl*, the last, and highest village in it; crossing, the first day, two

large branches of the *Baspá*, the *Chuling*, and *Gór*, from the *Cailás* range on the north; and, the second day, two other considerable streams, the *Mangsá* and *Shútí*. They first passed over tremendous blocks of coarse-grained granite, the decomposition of which seems to have formed the sand in the river; it gives the water a turbid appearance. The granite is white, and from a distance looks like chalk.

The first part of the valley has the same general character with most others in the *Himálaya*; but it is considerably broader. The face of the mountain exposed to the S.W., which is part of the *Cailás* or *Raldang* group, presents abrupt precipices and threatening cliffs, with little soil, and but few trees; the opposite face again is more gently sloped, and thickly wooded with pines, which are overtopped by a belt of birches. Near the top of this chain, there is a good deal of snow. The last half-mile to the village of *Rákchám*, situate in the western corner of the glen (and 10,500 feet above the sea), is a rugged descent upon enormous masses of granite. The dell has here a pleasing appearance, and it expands to three furlongs in breadth: half of it is laid out in thriving crops of wheat and barley, and the rest is occupied by sand-beds, which form many small islands, with the river winding among them. Just above the village, huge piles of black rock* rise abruptly, in numerous black spires, to about 9,000 feet higher, or nearly 20,000 feet above the level of the sea. Approaching *Chétkúl*, the dell becomes more contracted; the right bank becoming very precipitous, and almost mural to the *Baspá*. The altitude of the village is about 11,400 feet, and the highest fields are scarcely 200 feet more. The valley continues about 800 yards wide for two or three miles; the *Baspá* then makes a bend to the southward, and the view is shut up by snowy mountains of great height.

From *Chétkúl* the travellers attempted the *Kimliá* pass, at the head of the valley of the *Rúsú* river, a large stream, derived from a double source, one branch rising in the snow of *Saglá* pass, which bears nearly south; the other, or smallest, in the *Kimliá*, about S.W. Above the elevation of 13,300 feet, the level of the highest birches, the *Rúsú* is increased, in rapidity and turbulence, to a torrent, and foams in dreadful agitation and noise. Still higher up, the road ascends gradually, upon snow of immense thickness in the channel of the current, which now and then shows itself

* Composed of black mica (fine-grained), with a little oxide of iron.

in deep blue lakes. The travellers passed along the margin of one, 150 feet in diameter: the way was extremely dangerous, upon ice sloping abruptly to the water; in this there was no footing, till notches were cut with a hatchet, an operation which long delayed their progress. Latterly, they travelled over mounds of unfathomable snow, so loose as scarcely to be capable of supporting them at the depth of three feet. The guides had snow-shoes, which were at least five or six inches in breadth. They said, that early in the morning, before the sun had power, the snow would bear the weight of a loaded person; and in May and June, when the pass is most frequented, it does not sink at any time of the day.

The travellers reached the elevation of 15,500 feet, where the pass appeared to be 1,400 or 1,500 feet higher, over vast fields of snow.

The dell is broad (half a mile wide), and covered with snow in high wreaths. The mountains, which have a S.E. exposure, are nearly bare, a few patches of snow only appearing at great heights. The line of cliffs may be 17,500 feet. On the other side, the mountains are nearly of the same height, and they present a chain of mural precipices, eaten away by frost into forms like towers and steeples. Much of the rock near the summits is exposed; and snow, having lost its hold on their steep craggy sides, has accumulated below.

It had rained several hours; the sleet fell thickly, without any prospect of its clearing up. Messrs. Gerard thought it prudent to order a speedy retreat; especially as the guides were greatly alarmed, and strongly remonstrated against their proceeding further, lest they should fall into some deep chasm, concealed by soft snow.

The shower of sleet continued with them the greater part of the descent; and latterly changed to rain, with a milder climate. From the craggy sides of the dell the rocks were loosened by the rain, and followed each other in a continued crashing, and some pieces tore up the path a few yards from them.

Having caught severe colds, they did not renew the attempt to visit *Kimliá* (nor *Saglá*), but returned to *Chétkúl*; and were dissuaded from attempting the *Neilang* pass, where, several years ago, eighteen persons perished in the passage: since which time, few loaded travellers have ventured by that route.

Messrs. Gerard proceeded by the *Charang* pass (17,348 feet high) to the valley of *Nangaltí*. The inclemency of the weather rendered it very

arduous. They were detained three days at *Shalplá* (a resting-place for travellers) by incessant rain; on the fourth day their guides consented to proceed. Many snow-beds were crossed; and, about the height of 16,300 feet, continuous snow-beds commenced; at first, a gentle acclivity, and latterly a very steep slope, surpassing, in terror and difficulty of access, any thing which the travellers had yet encountered. The acclivity was at an angle of $37\frac{1}{2}^{\circ}$, of loose stones, gravel and snow, which the rain had soaked through and mixed together, so as to make moving laborious, and all but impracticable. The stones gave way at every step, so that it became necessary to use hands as well as feet. The travellers reached the crest of the pass at noon, in a state of exhaustion and numbedness of hands and feet, from continued exposure to snow and sleet, with a violent freezing wind.

The dell leading to the pass is very much contracted; and the ridges on each side are almost bare. The rock is generally a sort of slaty gneiss, sometimes in large masses, but more commonly tumbling in pieces, with little soil and less vegetation.

Here, as at *Shátúl*, Captain Gerard noticed the circumstance of the mercury appearing quite pure [perfectly fluid?], when they left camp; but, at the pass (when used for filling a barometer) it had lost its lustre, and adhered to the fingers and cup as if it were amalgamated.

The descent from the pass, for half a mile, was at an angle of 33° , upon gravel and snow, with a sharp-pointed rock occasionally projecting through it. Some of the loaded people slid down this declivity at the greatest risk. Travelling was rendered laborious on the easier slope of snow, from its sinking one and a-half to two feet. The fissures were beginning to appear, and the guides picked their steps with much caution, leaping over whatever had the least appearance of a rent. The snow fell fast; and a piercing wind blew with fury down the dell.

The principal branch of the *Nangaltí* has its source much further to the west; a rivulet joins it from the pass. The mountainous range having a N.W. aspect, is very rugged; and the snow (often of a reddish colour) presents enormous banks of sixty or eighty feet thick, as shown by the part towards the dell having fallen down where it cracked. This is always the case on the precipitous sides of the vallies, because the ridges, for a considerable way down, are too abrupt for the snow to rest upon them: it therefore accumulates in large quantities, where the inclination is more gentle; it then cracks, and tumbles down by its own weight, during the rainy

season, and leaves a perpendicular wall of eighty to a hundred feet in depth. The mountains on the other side were less steep, and the snow lies in continuous fields.

The travellers proceeded over heaps of loose stones, snow, and slush, at the point of congelation. They passed by several deep blue lakes, with their banks of frozen snow: these are always to be dreaded; and they made a circuit by a seemingly more arduous road, to avoid the danger. Two avalanches descended opposite to them: one of rock, which spent its force in distance, the smaller fragments just reaching them; the other of snow, but arrested by intervening rocks.

The rocks in the vicinity of *Kiúkúche*, an enclosure for cattle, on the banks of the *Nangaltí* (where they encamped, at an elevation of 12,400 feet, as indicated by the barometer), were granite, and fine-grained mica slate.

Four considerable streams were forded, which rise at the back of the *Cailás*, and joining the *Nangaltí*, at length mingle their waters with the *Tidúng* river.

After fording the *Nangaltí*, thyme, and further on juniper, mint, sage, and a variety of odoriferous plants, were met with. At *Kiúkúche* there were a few animals of the cross-breed, between the *yak* (*bos grunniens*) and common cow.

On either side, for a few hundred yards, there is a grassy slope, with juniper and other bushes; and just above it, the dell is inbound by craggy cliffs of horrid forms. A little further down, the glen becomes more contracted in breadth, and the mountains present mural faces of rock, which continue for two miles, to the union of the *Nangaltí* with the *Tidúng*.

Few of the loaded people arrived the same day; two of them stopped all night at the top of the pass, and tore up their blankets to protect their feet. Fortunately it did not snow, and clouds prevented severe frost, or they certainly would not have survived the night. People were despatched to their assistance; and all were up, soon after noon, next day.

Recommencing their journey, the travellers followed the course of the *Nangaltí* river, to its junction with the *Tidúng*, and explored the valley of this last-mentioned river, ascending to the village of *Charang* (12,000 feet), amidst mountains 18,000 feet high; and proceeding thence to *Thangi*, and afterwards to the confluence of the same river with the *Setlej*. The principal branch, retaining the name of *Tidúng*, flows from the E.S.E., having its source in Chinese Tartary.

The valley of the *Tidúng* is very narrow; in parts so much so, as scarcely to afford a passage for the river. The stream is furiously rapid, the declivity very great, and the rumbling of large stones, carried down with velocity by the force of the water, was incessant. For six or seven miles the fall of the river is 300 feet per mile, and in some places almost double: where it presents an entire sheet of foam and spray, thrown up and showered upon the surrounding rocks with loud concussion, re-echoed from bank to bank with a noise like thunder.

The dell of the *Tidúng*, at *Húns*, a Tartar village, is confined by towering cliffs of white granite and mica slate. The mountains in the neighbourhood of *Charang* are all of blue slate, naked to their tops, and exhibiting decay and barrenness in the most frightful forms. They tower in sharp detached groups to about 18,000 feet. No vegetation approaches their bases, whilst their elevated summits offer no rest to snow.

Where the dell was narrowest, there was so little space for the stream, that the road continued but for a small distance on the same side, and crossed the river repeatedly by *Sangas*; one was inclined at an angle of 15°. The travellers had to pick their way: one while upon smooth surfaces of granite, sloping to the raging torrent; at another, the route led among huge masses and angular blocks of rock, forming capacious caves, where fifty or sixty people might rest: here the bank was formed of rough gravel, steeply inclined to the river; there the path was narrow, with a precipice of 500 or 600 feet below, whilst the naked towering peaks, and mural rocks, rent in every direction, threatened the passenger with ruin from above.

In some parts of the road there were flights of steps; in others, framework, or rude staircases, opening to the gulph below. In one place is a construction still more frightful to behold; it is called *Rápiá*, and is made with extreme difficulty and danger. In the instance, it consisted of six posts driven horizontally into clefts of the rocks, about twenty feet distant from each other, and secured by wedges. Upon this giddy frame a staircase of fir-spars was erected, of the rudest nature; twigs and slabs of stone connected them together. There was no support on the outer side, which was deep, and overhung the *Tidúng*, a perfect torrent.

After surmounting this terrific passage, they came to another, where the footpath had been swept away. It would have been impracticable; but, from previous intimation, thirty people had been despatched the preceding

night from *Thangí*, and had just completed two tolerable *sangas* by the time the party arrived, so that they passed in safety.

The last mile and a-half to *Thangí* was better; the road ascended from the river, often by staircases and scaffolding; and at the village, the shade of the *Deödár* and *Neoxa* (same with Mr. Elphinstone's *Chilgoosa*), two species of pine, was again enjoyed.

Grámang, one of two divisions of *Thangí*, is pleasantly situate upon a southern slope; the houses rising above each other, with the inclination of the soil. There are few fields, but they appeared thriving. The grains were wheat, barley, *phápur* (*Polygonum?*), Siberian barley, and millet (*Panicum miliaceum*), with some patches of turnips and pease. The whole is neatly laid out, and intersected with aqueducts, whose banks are adorned with walnut, apricot, apple, and poplar trees. Above the village is a thick forest of pine: and the summits of the surrounding mountains are all peaked, and very rugged. On one side of the river they are fine-grained black mica, so hard, that it was difficult to break off a good specimen with a hammer; across the *Tidúng*, the rocks appear to be white granite.

The route from *Thangí* to *Marang* lies through a forest of pine (*Rí*), upon the slope of a hill, composed entirely of blue slate, often crumbling in pieces.

From the confluence of the *Tidúng* with the *Setlej*, the town of *Ribé*, or *Ridang*, has a charming appearance: yellow fields, extensive vineyards, groves of apricots, and large well-built stone houses, contrast with the gigantic *Raldang* mountains. These are scarcely four miles from the town.

*Marang** is a large town, surrounded by high mountains. Although 8,500 feet above the sea, it enjoys a mild climate. During eight days' halt, the temperature varied from 58° to 82°; and flies were very troublesome. The sun, even at this season (July), does not appear more than nine hours: was scarcely visible above the mountains before 8 a. m., and disappeared behind them at 5 p. m. There were alternately light clouds and sunshine, and now and then a little rain, which in this valley never falls heavy: the height of the outer chain of the *Himálaya* being sufficient to exclude the rains, which deluge *Hindusthán* for three months.

* Already visited by Capt. Gerard in 1818 and in 1820.

Having collected from the surrounding villages, supplies for ten days, Messrs. Gerard proceeded to examine the valley of the *Táglá* river, which has its source in Chinese Tartary. They travelled to *Nisang* (on the *Táglá*), a Tartar village, already visited both in 1818 and 1820; crossing the *Túngrang* pass, which was again measured, and the previous measurement (13,739 feet) confirmed.

The pass leads over a spur, which runs down to the *Setlej* river, from a cluster of snowy mountains, upwards of 20,000 feet high. The rocks are slate: it easily splits into large even slabs, which are well adapted for carving the sacred Tartar sentences upon them. Across the *Setlej* the mountains are of white granite, breaking into gravel, and more abrupt than on the hither side.

They proceeded along the banks of the *Táglá* to *U'rchá*, and thence to *Rakor*, through the *Ruthingí* pass, and near the source of a rivulet of that name, after passing the *Khátí*, which descends very steeply from the *Himálaya* on the south, in which direction a peak of vast altitude is visible. The elevation of the pass is 14,638 feet; that of the resting-place at *Rakor*, 14,100 feet. A few birches are growing 200 or 300 feet lower.

Upon the left bank of the *Táglá*, the height of the mountains is upwards of 16,000 feet, and no snow appears. The rocks are brown clay slate, and mica slate. Upon the right bank of the river, the mountains appear to be all clay slate, crumbling into soil, and forming a natural declivity. The summits seem to be 18,000 feet high, at least; and there is very little snow in streaks. Farther to the east is a large mountain, white with snow, and near it a naked ridge of rocks, ending in a number of sharp points, apparently formed of slate. In the vicinity of the source of the *Ruthingí*, several conical points are seen covered with snow.

The travellers continued along the banks of the *Táglá* to *Zongchen*, passing several streams which fall into it, and a larger one named *Kegóche*, which comes from the south (S. by W.), and one less considerable, called *Langúrge*, from the S.E., both very muddy. The *Táglá* itself is quite clear, and its course is from the N.E. They crossed at once by a *sango*.

The path lay upon broken slate and slippery soil, then upon inclined faces of rock; at one time ascending steeply upon loose stones; at another, descending abruptly upon rude steps and scaffolding, projecting over the stream, and between cliffs that subtend an angle of 60° or 65° on either side. Now and then these crags are perpendicular for 200 or 300

feet, and they even overhang the pathway. Large snowbeds conceal the river for several hundred yards: an immense load of stones and gravel lies above the snow. In one place the accumulation of rocks, which have fallen from the surrounding peaks, is sixty or seventy feet thick; and the river is seen rushing from beneath a large vault, whose under surface is frozen snow.

The height of *Zoncheng* is 14,700 feet, which, in lat. $31^{\circ} 36'$, according to received theory, should be buried under everlasting snow. The situation, however, is far different. On every side of the glen, which is a bowshot broad, appeared gently-sloping hills, for the most part covered with *Támá* (Tartaric furze). The banks of the river were covered with grass turf, and prickly bushes. Around, the land was covered with verdure; flocks of sheep were browsing, and deer leaping: altogether it was a romantic spot, wanting but trees to make it delightful.

During the march the sun was found at times powerful; but the temperature was evidently decreasing with the elevation. The highest observed in the day (23d of July) was 68° .

The rocks were limestone; the soil a stiff yellow clay, rent in every direction by small fissures, and seeming to have been under water. The surface was ground to dust.

The next stage was to *Zamsíri*, by the *Këubrang* pass; after tracing the *Táglá* (crossed frequently by snow-beds), until it was reduced to an inconsiderable rivulet at the foot of the pass.

The ascent of the pass is by no means steep, the angle being only 19° or 20° . But the difficulty of breathing, and severe head-aches, which all the party, not excepting their Tartar guides, experienced more or less, rendered the exertion of walking very laborious. As they advanced, vegetation became more scarce, till at length it wholly disappeared; and the last mile presented a scene of solitude and desolation.

The elevation was found by barometric measurement to be 18,313 feet above the sea. The pass is reckoned the boundary between *Kunáwar* and that part of Chinese Tartary which is under the authority of the Grand Lama of Lahasa.

There was very little snow in sheltered situations contiguous to it, but none in the pass itself. Several birds were heard, and especially the call of a species of pheasant, which lives near the snow.

The mountains enclosing the dell of the *Táglá* river, which lead to the

pass, are between 19,000 and 20,000 feet above the level of the sea, just tipped with snow; else they were covered with *támá*, a prickly bush, to which the travellers in a former journey gave the name of whins, and which they now called Tartaric furze. It is the ordinary fuel of the Tartars; and appears to thrive best among arid gravel, and in the bleakest places. Its upper limit near *Kěúbrang* was observed at something above 17,000 feet.

After halting some time, it began to snow; and though the thermometer was not below 41°, the violence of the wind, added to the difficulty of respiration, rendered the situation unpleasant; and the travellers hastened down to a milder climate.

Zamsíri, a mere halting place for travellers, on the banks of the *Shéltí*, to which they proceeded from *Kěúbrang*, is 15,600 feet above the sea, a height equal to that of the passes through the outer range of snowy mountains; yet there is nothing to remind one of the *Himálaya*. Gently sloping hills and tranquil rivulets, with banks of turf and pebbly beds, flocks of pigeons, and herds of deer, would give one the idea of a much lower situation. But nature (Capt. Gerard remarks) has adapted the vegetation to that extraordinary country; for, did it extend no higher than on the southern face of the *Himálaya*, Tartary would be uninhabitable by either man or beast.

It seems surprising (he goes on to observe) that the limit of vegetation should rise higher the further we proceed, but so it is:—on ascending the southern slope of the snowy range, the extreme height of cultivation is 10,000 feet; and even there the crops are frequently cut green. The highest habitation is 9,500 feet; 11,800 feet may be reckoned the upper limit of forest, and 12,000 that of bushes: although in a few sheltered situations, such as ravines, dwarf birches and small bushes are found almost at 13,000 feet.

In the valley of the *Baspá* river, the highest village is at 11,400 feet; the cultivation reaches to the same elevation; and the forest extends to 13,000 feet at the least.

Advancing further, you find villages at 13,000 feet, cultivation at 13,600 feet, fine birch trees at 14,000 feet, and *támá* bushes, which furnish excellent fire-wood, at 17,000 feet.

To the eastward, towards *Mánassaróvar*, by the accounts of the Tartars, it would appear that crops and bushes thrive at a still greater height.

The travellers descended the valley of the *Shélti* river to its confluence with the *Súmdó* river, and ascended to the crest of the *Húkëó* pass, of which the elevation is 15,786 feet. The soil is reddish, apparently decomposed limestone, with no large stones. The ground is thickly covered with green sward and beds of prickly bushes. No rocky points are seen, the whole being gentle slopes of gravel, much resembling some of the Scotch highlands; the *támá* at a distance seeming like heath. *Yaks* and horses were feeding on the surrounding heights; and the climate was pleasant; the temperature being 57° .

There are the usual piles of stones to mark the crest of the pass, and a great number built upon all the surrounding heights. At a distance they could not be distinguished from men; and were taken at first sight, by the servants, for Chinese come to dispute the pass. The guides assured them they were piles of stone; and a view through a telescope confirmed the assertion.

Three of the people, who were attending the cattle, watched the party for some time, until being convinced there were Europeans, they mounted their horses, and set off at a gallop. The travellers quickened their pace, determined to advance as far as practicable; but two miles further they were stopped by the Chinese, after they had crossed a rivulet with swampy banks, winding among rich turf, near which, they found many ammonites, at the height of 16,200 feet, on the elevated land between *Húkëó* and *Zinchin*.

The Tartars under Chinese authority were encamped, awaiting their arrival, of which previous intimation had been received, and pointed out a spot for their camp, and a line beyond which they should not pass. Their manners were polite, and their civility was requited by presents of tobacco, the only thing for which they seemed to have any, the least desire.

The height of *Zinchin* is 16,136 feet, and the eminences in the vicinity rise many hundred feet higher. In every direction, horses were seen galloping about, and feeding on the very tops of the heights; altogether there were about 200. Kites and eagles were soaring in the air; large flocks of small birds, like linnets, were flying about, and locusts jumping among the bushes.

Immediately across the *Setlej*, the mountains are abrupt; but, more to the east, there is a succession of gentle slopes. Beyond them again, appeared a lofty snowy range. It seemed to run N. 50° W. to S. 50° E. Clouds hang about it.

At this altitude the atmosphere exhibited that remarkable dark appearance which has been often observed in elevated situations. The sun shone like an orb of fire, without the least haze. At night, the part of the horizon where the moon was expected to rise, could scarcely be distinguished before the limb touched it; and the stars and planets shone with a brilliancy never seen, unless at great heights.

With a transit telescope of 30 inches, and a power of 30, stars of the fifth magnitude were distinct in broad day; but none of less size were perceptible. At *Súbáthú*, 4,200 feet above the level of the sea, stars of the fourth magnitude require a power of 40 to make them visible in the day.

The temperature was greater than expected: the thermometer rose to 60° in the shade, and at sunset was 42° . It sank to $30\frac{1}{2}^{\circ}$ before sunrise. About nine in the forenoon a wind from the S.W. began; it was at its greatest strength at 3 p. m., and subsided at sunset.

The climate is very different from that which is experienced in crossing the outer range of the *Himálaya* at the same season. Here, at the height of 16,000 and 17,000 feet, is abundance of fuel (*metóh*, bearing a beautiful yellow flower, and no prickles), good water, and a serene sky; there, at an inferior elevation, no firewood is nearer than five or six miles, the clouds hang around the mountains, the sun is rarely visible, and showers of rain are frequent.

Not being able to prevail upon the Tartars to allow them to proceed a step further, the travellers unwillingly began their return (27th of July). They again traversed the *Këúbrang* pass, and repeated their barometric measurement of it with the same result; halted at *Rishí Talam*, 15,200 feet high, two miles from their former stage at *Zongchin*, and proceeded by the *Gangtang* pass to *Rishi Irpú*, on the *Hóchó* river.

At the limit of vegetation (16,600 feet above the sea) it commenced snowing, and they were involved in a dense haze: the guides missed their way, knew not how to proceed, and became alarmed. They halted, therefore, for a while; and, the clouds clearing away for an instant, Messrs. Gerard got sight of a *shaghar*, or pile of stones, the bearing of which they took; and being surrounded by mist, steered towards it by a pocket compass. The ascent was steep, and they often scrambled over sharp-pointed rocks. They proceeded a mile and a-half, guided by the compass; and the lower clouds clearing away, they found themselves within half a

mile of the *shaghar*. The summit of the pass was measured barometrically, 18,295 feet above the sea.

A stream, that unites with the *Táglá*, lay upon the left the greater part of the way ascending the pass; they descended it along the *Hóchó*, which comes from the left, where there is a great expanse of snow. They followed its course to *Rishi Irpú*. The valley is generally half a mile broad. The river is picturesque: in one part a clear and shallow stream, in another it thunders over rocks in a succession of sparkling cascades. There are several arches of snow over it. In several places its course was partly arrested by rocks from above. It is concealed for a considerable space by a huge pile of stones, and it forces its way underneath, bursting forth in a large body of water. In other places it forms large deep lakes, and leaps over the embankments, with tremendous noise, in sheets of white spray.

Limestone, which had been the prevailing rock since they first met with it in the vicinity of *Zongchen*, near the *Táglá*, became more rare as they approached *Irpú*, and disappeared near that place. It is there succeeded by mica slate.

Next day they proceeded down the valley of the *Hóchó* to *Dábling*, a place visited likewise in the preceding year, in sight of the *Setlej*, and of the village of *Púi*, on its banks. By the way they passed the highest cultivation yet seen, consisting of barley, *phápur*, and turnips, at an elevation of 18,600 feet above the sea. A little lower, the ground was covered with thyme, sage, and many other aromatic plants, besides juniper, sweet-briar and gooseberries. At *Púi* there are vineyards and groves of apricots:* at *Dábling*, much cultivation, and plantations of apricots and walnuts.

After a halt of four days for astronomical observations, during which time the temperature was warm, varying from 61° at sunrise to 85° at noon, the wind blowing very strongly from the S.W., and the sky frequently obscured with light clouds attended with a little rain; they moved (4th August) along the banks of the *Setlej*, or in the bed of the river, to *Namgrá*. On the right margin of the river, the mass of rock (granite) is

* The apricots form a part of the subsistence of the people. At this season they are pulled, and exposed to the sun on the roofs of houses; when dried, they are not unlike prunes.

so steep, and the fracture so fresh, as to give it the appearance of having been recently broken.

Several temporary huts, perched high among the crags across the river, are the summer residence of the hunters of *Hango*, who roam among the rocks in quest of deer.

Kháb, a village of but two houses, a mile from *Namgía*, is immediately opposite the junction of the *Lí* or *Spítí* river, one of the largest tributaries of the *Setlej*, having its source in *Ladak*. The cheeks of the gulph (solid granite) seem perfectly mural for many hundred feet; one of the arms of the *Pargéúl* mountain limits the left side of the channel of the *Spítí*. The contrast between the two streams is striking: the *Spítí* issues from its almost subterraneous concealment in a calm blue deep body, to meet the *Setlej*, which is an absolute torrent, thundering over the stones in deafening clamour.

Namgía, containing eight houses, is the last or most eastern village in *Basehar*: the houses are built of granite, but their structure ill accords with the durability of the materials. The want of forests, to supply the timber necessary to give union to the walls, is the source of the bad workmanship: the granite blocks resist the mountaineer's rude implements.

The mountains on every hand are of stupendous height. Those immediately at the back of the village exclude the sun till eight o'clock; and the consequent deficiency of solar heat retards the ripening of the crops. They were here very backward: harvest was yet a month distant.

It had been determined to renew an attempt of penetrating eastward, beyond the boundary of British influence, into the upper valley of the *Setlej*. Accordingly they marched to *Shipki*, in Chinese Tartary, by the *Píming* pass (13,518 feet), the boundary between *Basehar* and Chinese Tartary. There could scarcely be a better defined limit: in front the face of the country is intirely changed; eastward, as far as the eye can see, gravelly mountains of a very gentle slope succeed one another. No rugged cliffs rise to view, but a bare expanse of elevated land, without snow, and in appearance like a Scotch heath. Just beyond the *Setlej*, the mighty *Pargéúl*, an immense mass, rises to 13,500 feet above the bed of the river, more than 21,000 above the sea. To the east of it, in the same granitic range, are several sharp pinnacles, nearly as high, being more than 20,000 feet above the sea: on the S.W., at the back of the town of *Shipki*, is an

enormous mass 20,150 feet high, crowned with perpetual snow. The *Shírang* mountain, over which the road to *Gárú* leads, exceeds 18,800 feet in actual height above the sea: yet only one small stripe of snow could be detected on it with the telescope.

Shipkí had been twice before (in 1818 and 1820) visited by the same travellers. They now received a letter from the *Garpan* of *Gárú* (in reply to one sent by them from *Zínchin*), prohibiting their advance eastward. At the same time the local authorities were instructed to furnish no provisions at any price.

Messrs. Gerard returned to *Namgía* by the lofty pass of *Kóngma* (16,007 feet above the sea): it is the usual resting place for beasts of burden. Furze and grass extend considerably higher on each side; and springs rise, which form a lake at the distance of 150 yards.

Intending to explore the valley of the *Lí* or *Spítí* river, and penetrate by that route as far as might be found practicable, they crossed the *Setlej* by a *jhólá*, or bridge of suspension, made of twigs twisted together. The bed of the river is here 8,600 feet above the level of the sea; the breadth of the stream is seventy-five feet.

From the *Setlej* the path leads up the face of a granite range to *Taz-hi-gang*, perched amidst ruins of a frightful bulk, at the height of 11,850 feet above the sea. The temple and residence of the Lamas are still 500 feet higher. Ascending upon loose rocks to the highest point of the road (13,200 feet), they turned the extremity of the range; and leaving the *Setlej* behind, bent their course to the north, having the *Lí* or *Spítí* on the left, about 5,000 feet below, and almost a complete precipice. The road continued at a general height of 13,000 feet, upon granite, crumbling into sand, and producing a few bushes of juniper and furze.

A fine prospect suddenly opened: a village (*Nákó*) in the heart of abundant cultivation already yellow, with a broad sheet of water, surrounded by tall poplar, juniper, and willow trees of prodigious size, and environed by massive rocks of granite.

Separate measurements, at three different times (1818, 1820, and 1821), by excellent barometers, and the boiling point of water, determine the height of *Nákó* a little more than 12,000 feet above the level of the sea: yet there are produced most luxuriant crops of barley, wheat, *phápur* (polygonum?), and turnips, rising by steps to nearly 700 feet higher; where

is a Lama's residence, inhabited throughout the year. The fields are partitioned by dikes of granite. At *Taz-hi-gang* they are enclosed by barberry and gooseberry bushes.

The seasons are similar to those of our northern latitudes, the grain being sown in March and April, and reaped in August and September. Snow generally falls towards the end of October. It seldom exceeds two feet in depth, but does not leave the ground for nearly six months. Want of moisture in the air prevents its earlier descent, since the beginning of October is winter, under a clear sky. In the middle of October 1818, the thermometer at sunrise was seldom above 20° ; now (in August) the temperature was 75° at noon, and never below 52° .

The effects of particular exposures and localities towards the development of vegetation cannot be more strongly contrasted than between this and *Namgía*; for, although here 3,000 feet higher, the crops were much farther advanced. Vast extent of arid surface on every side reverberates a surprising warmth, and favours an early harvest.

The leaves of poplar are given to cattle. Besides these, junipers and a few willows are the only trees at this elevation. Firewood is of furze (*tama*) alone, and it is scarce.

Messrs. Gerard were desirous of verifying by trigonometric measurement the elevation of their old high station on *Pargéúl*, just above *Nákó*. In 1818, Capt. G. made it 19,411 feet by three barometers, which agreed exactly (14.675 inches). In 1820 two other barometers were taken to this spot, and they showed 14.67 inches. The result of the trigonometric measurement now gave 7,447 feet above the former camp, which being 11,995 feet, makes the extreme height of the peak 19,442 feet above the level of the sea, differing 31 feet from the barometric measurement.

They proceeded along the banks of the *Lí* to *Chango*. Part of the road traversed a plain studded with enormous masses of rock, seeming, as Capt. G. remarks, to have been under water at no very distant period. The road then lay along the bank of a rivulet, over waterworn stones of many sorts, and crossing the stream enters the plain of *Chango*. The village is fully 10,000 feet above the sea; but this elevation does not prevent its enjoying a sultry summer, the temperature rising to 80° in August. The situation is pleasant, unlike the rude and sterile character of the country. The seasons are at least a month earlier than at *Nákó*: seed time begins in March, and harvest in July and August. Snow falls from No-

vember to March, but it is seldom a foot in depth ; and in April and May, rain is frequent. The grain crops are those noticed at *Nákó*, with *ógal?* millet, and fine fields of turnips, pease, and beans, all well tasted. There are likewise many apricots.

The plain lies east and west, in a dell, through which flow two streams, that no sooner escape from their dark and winding passages, which are bounded by lofty and inaccessible crags, nearly perpendicular, than they are conducted in tamer conduits, by the industry of man, to the fields, which rise one above another in terraces. This glen is terminated on the north and south by bare thirsty ridges, on which nothing animate appears. On the west is the *Lí* or *Spítí* river, flowing in a tranquil expanse of bed. On the east, at the head of the plain, is a high-peaked mountain, on whose summit rests snow.

The next march was to *Changrezhing* by the *Charang lama* pass, of which the elevation is 12,600 feet. Here limestone was again met with, as well as clayslate, &c. Pebbles imbedded in clay, and small rounded stones are numerous ; all having the appearance of having been acted upon by water, although the *Spítí* is nearly 3,000 feet below this level, and no rivulet is near. The *Chálá-dókpó*, a considerable stream from the eastward, extremely muddy, and rushing with inconceivable rapidity between perpendicular cliffs of granite and mica slate, at an altitude of 11,400 feet above the sea, was crossed by a wooden bridge. The breadth of the stream was twenty-five feet.

Changrezhing is a dependency of *Chango*, where are a few ruinous houses, inhabited in summer. Its height is 12,500 feet above the sea. The grains cultivated are wheat, barley, *phápur*, and Siberian barley. The rocks in the vicinity are granite, gneiss, and mica.

Having understood that Chinese were at a short distance in front to stop them, Messrs. Gerard did not move their baggage, but advanced to meet the opposite party. They crossed two rivulets, near which they saw the black currant in the highest perfection, and larger than any which they had hitherto met with. They found fifty Tartars awaiting their arrival a mile S.W. of *Chúret*, the first Chinese village. Not being able to prevail on them to allow of their proceeding, they returned to *Changrezhing*.

In the afternoon they visited the confluence of the *Spítí* with the *Zangcham* or *Párátí* river, which comes from the N.E. The last is the larger river, being ninety-eight feet broad ; the *Spítí* (from the N.W.) but seventy-

two feet; the former rushing with great fury and noise, the latter flowing with a more gentle current. The elevation was found to be 10,200 feet above the sea.

A mile from *Changrezhing*, proceeding towards the river, they got among the crags and waterworn passages, whence it was no easy matter to extricate themselves. Capt. G. remarks, that they were evidently on the former bank of the river: the whole bank was a concreted rubble, hardened by the air on the retiring of the waters. After descending a series of difficult steps or ledges, each seeming to have once been the bank of the river, they arrived at its bed. The distance from *Changrezhing* was three miles and a half.

They proceeded by the *Chóngbá* pass (11,900 feet above the sea), and crossing the *Spítí* by a good bridge of three fir trees planked over, to *Shiálkhar*, where there is a fort in a commanding situation, on the brink of the channel. The walls are of loose stones and unburnt bricks, with houses all around the inside. It is in the parallel of 32° N. lat. The river is here 10,000 feet above the sea. The climate resembles that of *Chángo*. The grain crops are the same; and apricots are plentiful, and of very superior flavour.

Lári, the first village in *Spítí*, a dependency of *Ládák*, is distant about eleven miles to the N. W. Messrs. Gerard wished to visit it, but the *Spítí* intervened, and was then unfordable, and there are no bridges. For the same reason they could not see the hot wells between the *Spítí* and *Zangchám*, four miles north of *Shiálkhar*. They are in great repute in this quarter, and diseased people resort thither from long distances, either to bathe in them, or drink the waters.

The travellers proceeded along the glen of the *Spítí*, to *Lakh*, which is 12,900 feet above the sea, whence they descended into the bed of the *Yúlang* river, a middling sized stream, rising among perpetual snow in the west. It is increased by rivulets from either side; and above the ford, a stream gushes from the brow of the mountain, and is precipitated into it in a transparent cascade. Hence the angle of ascent was 34° , rising 2,000 feet perpendicular, in a distance of one mile, over hard gravel. Difficulty and danger in a thousand forms attend the traveller's progress: when he clings to the bank, he frequently brings away a piece of it. In some places there are many large stones amongst the gravel, which it requires much caution to avoid setting in motion, for one displaces others, so that sometimes

a space of 100 yards of gravel and stones moves downwards at once, and the larger stones, bounding over the slopes, are showered to the bottom amidst much confusion and noise. Now and then niches for the point of the foot were cut : and Messrs. Gerard, not taking off their shoes, as their followers did, were often obliged to grasp the nearest person's hand. They reached the top without accident, much wearied with climbing, and rested upon the verge of the gulph, and enjoyed a refreshing breeze at the height of 12,700 feet, blowing over an extensive tract, which resembles a heath. Thence they descended to the village of *Liu*, which occupies a slip of land on the right bank and in the bed of the *Spítí*, embosomed by sterile masses, glowing under the ardor of a tropical sun. From this the climate acquires a delicious softness. On the east is a solitary rock sixty feet high, which was formerly the site of a fort now in ruins : southward, the plain is washed by a stream called *Lípak*, falling into the *Spítí* a bowshot distance.

They halted on the 15th August, on account of rain. In the evening, when it cleared, they visited the *Spítí*, which is here broad. It was measured 258 to 274 feet wide. The river is rapid, and at this season appears to contain a greater body of water than the *Setlej*. The snow had within two days descended on the granite range of mountains across the *Spítí*, to 16,000 feet. At *Náko*, judging from the heights before determined, it was certainly not under 18,500 feet.

Crossing the *Lípak* under the village, by a firm and well raised *sango*, they resumed their journey (16th August) and ascended, by a steep path over granite and mica slate, to the height of 11,600 feet above the sea, and proceeded at this level for a mile, winding round sharp projections of rocks into recesses, in and out again, where the pathway bordered upon precipices of 2,000 and 3,000 feet. They turned their backs upon the *Lí* or *Spítí*, and its deep abyss, and entered the *Chóling* dell, which sends its waters to that river.

The mountains have an extremely sterile and parched aspect. No grass covers them ; and a few tufts of aromatic plants are all the vegetation they here present. The appearance of a village and green fields was singularly refreshing. Those of *Chúláng* and *Hára* were passed, to encamp at *Hángo*.

This village is 11,400 feet above the sea ; situate at the head of a dell in the bosom of cultivation. There are a few poplars, but no apricots. The luxuriance of the crops can scarcely be exceeded. The ear of the Siberian

barley showed so large and full, that the average of eight picked casually was seventy-eight fold. Most of the fields were yellow, and a few had been cut.

The glen runs east and west, and has a nearly level surface. A stream flows on each side of it, and one through the middle; and the supply of water never fails.

The mountains around are limestone: the same had been observed at *Chóling*. Those on the north are steep and naked; on the south more gently inclined, and they are covered with grass and furze.

The march of the next day was to *Súngnam* by the *Hangrang* pass (14,800 feet above the sea). The limestone is broken by the action of the weather into a gravelly surface, thickly clad with furze, juniper, and short grass, the arid pasturage of the cattle. Horses were seen loose, feeding at the height of 15,000 feet above the sea.

From the pass the view extended to the elevated range between the *Setlej* and *Indus*, from N. 15° E. to N. 10° W. It is most probably a continuation of the lofty range seen from *Kéúbrang*: it was so completely covered with snow, that not a rock could be distinguished by a telescope of large magnifying power.

Limestone disappears, and clay slate is frequent, near *Súngnam*. This populous place, in the valley of the *Dárbúng*, had been already visited by Messrs. Gerard (in 1818). It is 9,350 feet above the sea. At this place, where they halted for several days (17th to 28th August) Capt. Gerard remarks: "The situation is fine, in a glen bounded on the north and south by lofty ranges of mountains, the passes through which are nearly 15,000 feet above the sea. On the N. W. up the course of the *Dárbúng*, is a high pass to *Spítí*; and to the S. E., the *Setlej*, at the distance of several miles. For the space of five miles, this valley presents a sheet of cultivation. There are two crops here, and the grains are barley, *ogul*? and *phápur*? there is plenty of pease, beans, and turnips; and wheat and Siberian barley thrive at great elevations upon the slopes of the dell. Around the village are vineyards, and orchards of apples, apricots, and walnuts.

"In this neighbourhood the pine, to which we had long been strangers, begins to raise its head; it is stunted in growth, and thinly scattered upon the surrounding mountains.

"We stopped here till the 28th August, and at times we were somewhat incommoded by the heat; during our halt the temperature of the open air

ranged from 60° to 82°. For two or three hours after sunrise low clouds were seen hanging about the hills, but they dispersed as the day advanced. In the evening, and during the night, dark clouds charged with thunder appeared towards the N. W. but there was scarcely any rain. About 1 p. m. an easterly wind sprung up, and it increased in violence till five; when it subsided till 9 p.m.

“Snow falls in November, and covers the ground more or less until March; but it is seldom two feet in depth.

From *Súngnam* the travellers proceeded to visit the *Mánerang* pass, and thence to *Mánes*. I continue to transcribe Captain Gerard's account of this excursion, in his own words, unabridged.

“The road from *Súngnam* to *Rópá* (four miles) lies in the dell along the bank of the *Dárbúng*. Fields and hamlets are scattered on either hand; and apricots and apples occur at every step. The glen is about a bowshot in breadth; and the mountains on each side are crumbling clayslate and limestone, bearing a few dwarf pines. Near the village of *Shibé* is a copper mine, which was formerly worked. The height of *Rópá* is 9,800 feet: so the seasons and productions are similar to those at *Súngnam*.

“We had with us twelve days' supplies, which, from the goodness of the roads, were transported upon horses, mules, and asses. Here, however, we were obliged to exchange our carriage for sheep; and the adjustment of the loads occupied so much time, that we found it necessary to halt for the night.

“The next day we proceeded to a reating place for travellers, named *Pámáchin* (ten miles and three quarters). At first the road was level for a short way, and it led through fields of beans and bowers of apricots: then there was an ascent of two miles and a half, latterly steep: but the path was good to *Tómókěú* pass, 13,400 feet high. The surrounding hills are slaty, and crumble away at the surface, which is almost naked: a few dwarf pines and juniper bushes occurring now and then.

“Below this the first branches of the *Dárbúng* are concentrated. The streams are amongst perpetual snow, and rush down from different directions in clamour and foam to unite their waters.

“The next four miles are of an extraordinary nature, scarcely to be described: rugged cliffs, banks of hard gravel much inclined to the river, mural precipices, and sharp pointed rocks succeed one another.

“After a series of difficulties and dangers, we descended to a considerable

stream, which we crossed by a wooden bridge, and proceeded upon level soil to *Súmdó*, a few huts occupied by the shepherds and their flocks. Hence to camp, a distance of two miles, the path was nearly plain, and we passed through a belt of birches at the immense elevation of 14,000 feet.

“ It is so named, after the species of juniper called *Pámá* (which is the only wood for fuel found in the vicinity) and is 13,700 feet above the sea.

“ This was a very fatiguing march for loaded persons. *Súmdó* is the usual stage: and the next does not cross the pass; but it had been snowing for some days upon the heights around, and our guides preferred crossing the chain on the second day from *Rópá* for fear of bad weather.

“ Part of the baggage arrived during the night; and from this time forward the tent, with some other things, were lost sight of.

“ The *Dárbúng* is here much reduced in size. The cliffs rise from the water's edge in wild disorder; and every year marks them with decay. Their sharp summits crumble away by frost and snow; and large portions of rock are precipitated into the bed of the river.

“ The following day we marched to *Sópóná*, a halting place for travellers, distant eight miles and three quarters.

“ The road lay upon the bank of the *Dárbúng*, which it crossed thrice by immense arches of snow, covered with heaps of stones that had fallen from above.

“ The mountains are of limestone, and end in peaked summits of many curious forms, inclined to the north at various angles. Not a trace of vegetation meets nourishment there; and the snow cannot find a rest, but is hurled down, together with the rock itself, and is exhibited at the bottom in accumulations of a frightful magnitude.

“ We had now come two miles and three quarters, and the dell was terminated, and close round. The *Dárbúng* is lost among the fields of snow where it is generated; and the whole space on every side is floored with ice and frozen snow, half hid under stones and rubbish. In some places the snow is of incredible depth, and lies in heaps. Having accumulated for years together, it separates by its gravity, and spreads desolation far and wide.

“ We had never before observed such enormous bodies of snow and ice, nor altogether so wonderful a scene. So rapid and incessant is the progress of destruction here, that piles of stone are erected to guide the traveller,

since the pathway is often obliterated in a few days by fresh showers of splinters.

"Our elevation was now upwards of 15,000 feet, although we had but ascended in company with the river, against its stream. Here only began our toils, and we scaled the slope of the mountain slowly; respiration was laborious, and we felt exhausted at every step. The crest of the pass was not visible, and we saw no limit to our exertions.

"The road inclined at an angle of 30° , and passed under vast ledges of limestone. The projections frowned above us in new and horrid forms, and our situation was different from any thing we had yet experienced.

"Long before we got up, we were troubled with severe headaches, and our respiration became so hurried and oppressive, that we were compelled to sit down every few yards; and even then we could scarcely inhale a sufficient supply of air. The least motion was accompanied with extreme debility and a depression of spirits, and thus we laboured for two miles.

"The last half mile was over perpetual snow, sinking with the foot from three to twelve inches, the fresh covering of the former night. The direct road leads in the centre of the gap, but we made a circuit to avoid the danger of being swallowed up in one of the deep rents, which were now covered up with the new snow.

"The day was cloudy, and a strong wind half froze us. The rocks were falling on every side, and we narrowly escaped destruction. We twice saw large blocks of stone pass with incredible velocity through the line of our people, and between two of them not four feet apart.

"We reached the summit of the pass named *Mánerang* at half past two p. m. Its elevation is 18,612 feet by barometric measurement.* There is here a very circumscribed spot, where is a *shaghár*, or pile of stones, free from snow.

"Leaving the pass, we travelled over snow, and descended gently for a mile. The wind blew with great violence, and benumbed us; but the sun shone bright and caused a reflexion that affected our eyes, but did not inflame them much: for at this season the snow is soft and somewhat soiled; but in winter, when it is frozen and sparkles like diamonds, the inflammation is very distressing and painful.

* The particulars of the measurement are omitted.—C.

" After quitting the great snow-bed, the road became extremely rough and difficult, leading over the scattered wrecks of the cliffs and patches of melting snow, and along the edge of a stream in a channel of solid ice.

" The adjacent ridges are wholly limestone, without a vestige of vegetation; they are even deserted by the snow, and exhibit an enormous extent of pure rock, and shoot into slender summits of a great variety of forms.

" We encamped at the foot of the slope that stretches from the pass, where the glen takes a regular shape; the stream spreads out and ripples upon sand and pebbles; the mountains slant away, and some stunted vegetation appears at their bases.

" The elevation of the camp was 15,200 feet above the sea.

" At sunrise of the following day the thermometer was at 31°; but the night must have been colder, for the dew which fell upon our bed clothes (we had no tent), was so completely frozen, that in the morning our blankets were as tough as the hardest leather.

" We proceeded towards *Mánes* (distant six miles and a quarter) through the dell that leads to *Mánerang* pass, along the bank of a rivulet which has its source amongst the snow-beds in that direction. There is a good deal of soil and bushes, and we passed fine crops of wild leeks at the height of 15,000 feet.

" Three miles and a half from camp we came to an open valley, being an expanse of sand and pebbles. We followed the stream till it entered a lake upwards of a mile wide; and here, leaving it to the right, we proceeded to *Mánes*, winding through low gravelly hills covered with *tamá* bushes.

" *Mánes* is a large village (of about fifty houses) in two divisions, separated by a stream. It is elevated 11,900 feet above the level of the sea, and lies on the right bank of the *Spítí* river, 400 or 500 feet above its bed.

" Around the village is some level soil, bearing crops of wheat and barley, and (*awá*) Siberian barley, which do not extend higher than 12,000 feet above the sea. The grains were almost ripe, and there were a few poplars in the vicinity."

After a halt of a day at *Mánes*, where the temperature varied (1st September) from 52° at sunrise to 81° at the hottest time of the day, Messrs. Gerard proceeded to *Téngdí*, a small village in the district of *Pínú*, comprised in the province of *Spítí*. They kept along the right bank of the river, a little above the stream, and then descended into the bed of the

Spítí river, to the village of *Sólák*. The dell is frequently a mile across, and the river winds through it in many channels, among islands of sand and pebbles, which are covered with barberry and other bushes. The fort of *Dánkar*, opposite this, is a considerable place, containing about forty houses, which, as at *Shiálkhar*, are inside. The walls are partly stone, partly mud, and the position is among rugged projections of gravel. Its altitude is not less than 13,000 feet above the sea. Above the fort two rivers unite; the largest, which has a bridge of ropes over it, rises in the *Páralásá* range on the N.W., and is called either *Spítí* or *Kúnjom*; the other, also a large stream, is named *Pínú*; its principal branches have their sources near *Tári* pass, on the S.W.

Near *Sólák*, where a meridian altitude of the sun was taken, is the highest latitude Messrs. Gerard reached in this journey, viz. $32^{\circ} 5' 34''$.

The best road crosses the *Pínú* at this place, and proceeds on the other side; but the stream was not fordable. It was attempted, but the current was found to be much too rapid. They had no choice but to encounter the difficulty of a most frightful descent. In one place is a notched tree from rock to rock, for the passage of a chasm: beyond this, a line of rocky ledges excavated for the toes to enter: above the crags overhang, and beneath is a precipice more than 100 feet deep. Unloaded people get over with the utmost difficulty; the baggage therefore was lowered by ropes. Immediately beyond this they came to an inclined rock, 100 feet high, which they had to climb over: it was nearly smooth, and could scarcely be ascended barefooted. The path continued dangerous for a mile and a half farther, upon hard gravel sloping steeply to the river. The dell is from a quarter to half a mile wide, and is occupied by sand and limestone pebbles: the mountains on either side are of limestone, sharp at the summits, but crumbling below.

Téngdi is 12,000 feet above the level of the sea: the houses are two stories: the lower half built of stone; the upper of unburnt bricks; the roofs flat: and on them the firewood, collected with great labour, is piled. Not a single tree is near, and the few prickly bushes seldom exceed three inches in height. The climate here is cooler than at *Mánes*. The temperature at sunrise was 45° , and in the middle of the day 78° .

The district of *Spítí*, which comprises *Pínú* as well as *Mánes*, is situate between Chinese Tartary, *Ladák*, *Kúlú*, and *Basehar*, and pays tribute to each. The inhabitants are all Tartars, and follow the Lama religion. There are lead mines. The villages are from 12,000 to 12,500 feet above

the level of the sea. Toward *Ladak* the habitations must be still more elevated, and the country very barren, and the climate inhospitable.

It was the intention of Messrs. Gerard to have gone on towards *Ladak*, and returned by the *Tári* pass, which is the most direct road. But intreaties and the offer of a douceur of 150 rupees were unavailing: the *Lafa*, or chief person, would not hear of their proceeding onwards, or attempting the *Tári* pass.

After a fruitless negociation, which lasted two days, they returned to *Mánes*, and thence to *Sípóna*; and again (7th Sept.) by the *Máneram* pass to *Pámáchan*, *Súmdó*, and *Rópá*. The barometric measurement was repeated with nearly the same result. The *Dárbúng* river was only half its former size; for a few days had brought on winter; and the stream was now but slowly and scantily supplied amongst the ice. The snow had not descended more than 400 feet lower, since they last crossed the pass, but the great fields had a new thick covering frozen hard. Shortly after leaving the pass, it began to snow, and continued till they arrived at *Pámáchan*. Upon the old snow-beds it lay at 14,500 feet; but what fell upon the ground, melted at 16,000 feet.

Súmdo is about 12,500 feet above the level of the sea.

They crossed the *Dárbúng* under the village of *Geöbúng*, and ascended the face of a thinly wooded hill to the elevation of 13,500 feet, where they encamped at the distance of a mile from any kind of fire-wood; but the spot afforded water. The upper limit of the pines in this neighbourhood is 12,300 feet; the juniper scarcely extends 100 feet higher. At sun-rise the thermometer was 39°. Every thing around was covered with hoar frost.

They ascended the *Rúnang* pass, 14,500 feet above the sea; the mountains are of clayslate; and the creeping juniper, as if it had found a congenial soil, spreads its roots higher than the pass.

Descending from the zone of frost, they travelled several miles upon an undulating tract much indented, but preserving a height above the limit of trees; and leaving the populous villages of *Kánam* and *Labrang* at a profound depth below on their left, they descended into the dell in which *Lípe* or *Lídang* is situate. The village is considerable, the houses entirely built of *Kélú* pine, small, compact, and exactly resembling cisterns.

The bottom of the dell stands 8,700 feet above the sea; the vine is cultivated; and there are orchards of fruit trees around. A few of the

grapes were now (10th Sept.) ripe, and the apples, which are the largest observed in *Kunáwar*, are of a delicious flavour.

The mountains are clayslate, granite, gneiss, and mica slate.

The travellers proceeded by the *Werang* pass (13,000 feet above the sea) crossing the *Késhang* river (a large and very rapid torrent forming a series of waterfalls) by a good wooden bridge, to *Pangpá* or *Pangí*, 2,500 feet above the *Setlej*, and 9,200 feet above the sea. There is here very little soil or level ground: the houses are crowded together; and the vineyards, fields, and pasture lands, belonging to the village, are miles distant.

The march was through a fine wood, large beds of juniper, and fine forests of pine, most part of the way. The upper limit of the pine was observed at 12,000 feet, the highest birches at 12,500 feet; and the rhododendron at 12,700 feet.

This day (11th Sept.), Captain G. observes, terminated their adventures amidst frost and desolation. They bade farewell to the serenity of a Tartaric sky and its charms. "Before us," he says, "we beheld dark clouds; we already felt the moist warmth of the periodical rains, and wished ourselves back among the Tartars, their arid country, and vast solitudes."

The rest of the journey follows the course of the *Setlej*, until it emerges from the mountains into the plains of Hindusthan.

They now entered the lower *Kunáwar*, and crossing, by a *sango*, the *Malgún*, a rapid torrent passing to the *Setlej*, they traversed a pine forest along a belt of highly cultivated land interspersed with orchards and the richest vineyards: in the midst of which is *Chíní*, a large village, contiguous to which are seven or eight others. The soil slopes gently to the *Setlej*, and is loaded with fine crops. It is the most extensive plain in lower *Kunáwar*, and forms a striking contrast with the heavy woods and rocky cliffs which overhang it. Just opposite are the huge *Raldang* peaks.

Here, on both sides of the river, grapes attain the greatest perfection. Some are dried on the tops of houses; some made into spirits; the rest eaten ripe. Eighteen varieties, distinguished by separate names, derived from colour, shape, size, and flavour, are cultivated in *Kunáwar*.

From *Chíní*, the road assumes very rugged features; many rude balconies, flights of steps, and notched trees occur. The soil is crowded with countless varieties of gay flowers and many odoriferous plants. Cumin is plentiful, and forms an article of export to the plains.

The height of this spot is 10,200 feet. The rocks are granite and gneiss, forming a succession of precipices, with a solitary tree here and there. The path is narrow, and skirts the brink of the abyss, looking down upon the *Setlej*, 4,000 feet below-

Rógí, where they halted, is 9,100 feet above the level of the sea. Towards the *Setlej* there are vineyards, and around the village apricots, peaches, and apples.

Thence they ascended to the height of 10,900 feet through a forest of straggling pines, of the species called *Ri* or *Niora* (Mr. Elphinstone's *Chilgusa*.) It does not here flourish to the westward of *Wanghu*. The road rises and falls upon sharp pointed rocks, and now and then a flight of steps occurs. Opposite is the confluence of the *Baspá* with the *Setlej*. Its waters make a very considerable addition to this far-travelled river. The road descends precipitously (2,600 feet) to *Rúngar*, a small stream. The face of the hill is unwooded, but beautifully diversified with wild flowers, and clothed with rich pastures for thousands of sheep. Hence to *Mirú*, or *Mirting*, a small village 8,550 feet above the sea, the path ascends and descends amidst dwarf pines and oaks.

The *Yúlá*, a considerable stream which rises amongst the snow in the N.W. and falls into the *Setlej*, was crossed 1,200 feet below the village. On its banks are many fertile fields. Thence the road ascends through a wood of oak and holly, which affords shelter to many varieties of pheasants; passes the village of *U'rní*, and arrived at *Tholang*, a village containing fifty-five families, and agreeably situated on both banks of a rivulet. It is 7,800 feet above the level of the sea. The whole of the rocks in this tract are gneiss. In several spots the ground had been torn up by bears in search of the honey of the field bee, which is here common.

At a short distance from *Chegaon*, the road passes under a natural arch of granite formed by the contact of two immense blocks. The travellers then descended to the *Setlej*, and continued for several miles along its banks, sometimes a little elevated above it, more frequently dipping down to the edge of the stream, which is very rapid. The rocks on both sides are worn into many caves, which re-echo the roar of the river with tenfold noise.

A very dangerous ascent was next encountered along the face of smooth ledges of granite, very steeply inclined to the *Setlej*; in these the niches for support scarce admitted half the foot, and were cut at very inconvenient distances.

Arriving at the summit, the road again descended into an abyss 1,200 feet deep; the distance was but half a mile, which shows the steepness of the slope.

The *Wangar*, a mountain torrent, here tears its way amongst vast masses of granite with frightful velocity and noise. The cascades formed by the rocks in its bed, throw up the spray to an amazing height, washing the crags which are loaded with a rank vegetation. In the dell of this torrent lies the secluded district of *Wángpó*, containing seven small villages.

The *Wanger* is formed by two streams: one called *Surch*, rises amongst the snow, the other, which retains the common name, proceeds from the foot of *Tári* pass.

Pinú is about four marches from *Wángpó*; and it was by the *Tári* pass, Messrs. Gerard intended to return, could they have prevailed on the *Lafa* to concede to their wishes. The pass is not reckoned so high as *Mánerang*, and probably does not exceed 17,000 feet.

After crossing the *Wangar* by a wooden bridge, the road continues along the edge of the *Setlej* for half a mile to *Wangto*, where there is a bridge of ropes across the river. Its breadth within the banks (which are of granite) is here 92 feet. It is the narrowest point: the average breadth in this part is from 250 to 300 feet. The bed of the river is 5,200 feet above the sea.

Messrs. Gerard stopped in a large natural cave till three o'clock, and having seen their baggage across, proceeded to *Nangánéö*, by a very steep and rugged ascent, and then along a well cultivated hill face.

The journey was troublesome and fatiguing. It rained, slightly at first, but latterly poured down in torrents.

Nangáneo is a tolerably sized village, 6,900 feet high (above the sea). A few grapes are cultivated in this district; but, owing to the periodical rains, do not thrive. Pear trees, bearing large and abundant fruit, are frequent near the villages. The fruit is dried upon the tops of houses, and forms part of the winter stock.

Proceeding towards *Tarándá*, the travellers passed through a beautiful wood of stately pines, many of them from 20 to 27 feet in girth; the pines are called *Kélú* by the natives. This timber is almost everlasting. It resists the attack of insects, and is therefore used in the construction of temples, houses, and granaries. It seldom occurs below 6,000 feet, nor above 12,000 feet from the level of the sea.

Leaving the forest, they descended by a narrow rocky path, among dark thickets of oaks, holly, yew, and horse chesnut. They here crossed the *Saildang* torrent, by three rude alpine bridges, over as many large and very rapid streams, which flow, or rather rush from their sources in the *Himálaya* to the southward, descending, in a succession of cascades, to the *Setlej*, a couple of miles below the bridges.

After crossing the *Saildang* there was a mile and a half of very steep ascent, which required some agility to surmount, without slipping down the precipice. Rank grass, from 8 to 10 feet high, concealed the intricacies of the path, and rendered it necessary to pick the way with the utmost caution. Thence to *Taránda* the road led through woods of pine. It rained heavily all day, and the baggage did not arrive till sunset.

Taránda is 7,100 feet above the sea. Gneiss and mica slate appear to predominate here, and granite is not so frequent. Nearly opposite this, to the south, the *Himálaya* mountains may be said to end.

The travellers halted for a day on account of rain, and proceeded on the following (18 Sept.) to *Súrán*, a tiresome journey, made more disagreeable and fatiguing by incessant rain.

They crossed the *Chaundé*, a large and impetuous stream, by a dangerous sango of two thin spars, one much lower than the other, and traversed a dark forest of oak and holly. Inclined rocks, and soil drenched with rain aggravated difficulty to danger. In fording a rapid stream, in which they were completely drenched, many of the loads were soaked with water. Some of the geological specimens were rendered useless by the writing on the paper envelopes being effaced; and the whole of the botanical collection, with the exception of very few plants, was entirely destroyed.

Maniati gháti, the ordinary stage between *Taránda* and *Súrán*, parts *Kunáwar* from *Dasau*, another of the great divisions of *Basehar*. The country westward assumes a more civilized appearance: villages are more thickly studded, cultivation more abundant, and not so circumscribed by huge masses of rock. Numerous rills trickle down from the mountains, and afford ample supplies for the fields, which are chiefly rice.

Súrán, 7,250 feet above the level of the sea, is the summer residence of the *Basehar Rájá* and his court. The climate is fine. Three miles from this, near the *Setlej*, are hot springs. Formerly human sacrifices were offered at a remarkable temple sacred to *Bhímá Cáli*, the patroness of *Basehar*. They have been disused since the British conquest.

The travellers halted four days (19th to 22d Sept.) on account of incessant rain, waiting for the reconstruction of a *sango* over the *Manglád* torrent, which had been washed away by the flood. The temperature was stationary at 50° during the rainy weather, but rose to 64° when the weather cleared. They now resumed their journey, crossed the *Manglád* by a crazy bridge of two spars connected by twigs. The stream was frightfully rapid. The ascent from the dell, steep as the descent to it, was more difficult; the path lying upon mica wet with rain, and slippery at every step.

Next day (23d Sept.) brought the travellers to *Rámpúr*, the capital of *Basehar*. It is on the left bank of the *Setlej*, 3,300 feet above the sea, in lat. 31°. 27', and long. 77°. 38'. The houses are of stone and slated, and some are very neat. The spot is hot and unhealthy in summer, and as cold in winter. Under the town is a rope bridge of 211 feet across the *Setlej*, leading to *Rúlú*. On the opposite summit of the range, which is lofty, are three forts, crowned with huge towers and battlements, which give them an imposing appearance.

Following the banks of the *Setlej*, and crossing *Nawagari*, a large stream, by a well-constructed wooden bridge, they found the dell expand at *Dattanagar*. Hitherto the valley of the *Setlej* has been narrow, confined between abrupt mountains. It now forms a flat, three miles wide, well watered by canals, and bearing luxuriant crops.

A few miles further they forded the *Běári* torrent, and finally emerged from the glen of the *Setlej* by a very fatiguing and steep descent of 4,000 feet perpendicular height; and, three miles further, by a winding road through woods of oak, yew, and horse-chesnuts; and arrived at *Kótgarh*, where the survey terminates.

It will have been remarked in the preceding narrative, as in former accounts of the same travellers, and of Mr. Moorcroft, Mr. Fraser, and others, that at an elevation where the density of the air is diminished five-twelfths, that is, where the barometric pressure is reduced to $17\frac{1}{2}$ inches or seven-twelfths of the atmospheric weight at the level of the sea, (which takes place at an altitude of nearly 15,000 feet above that level,) difficulty of breathing is experienced, attended with lassitude and severe head-ache. The native

mountaineers of the *Himálaya*, who feel it not less sensibly than strangers, ascribe the sensation to presumed exhalations of a supposed poisonous vegetation at that vast height. At a less elevation no such effects are perceived. Inhabited places were visited by Messrs. Gerard, at the height of more than 13,000 feet above the sea; and cultivated fields were seen at 13,600 feet, and cattle pasturing at a still greater altitude.

The diary of this journey supplies ample confirmation of a position advanced by me some years since, in reply to some hasty inductions, grounded on imperfect experiments and insufficient observations, as to the limit of perpetual congelation. It was not to be supposed that the same mean temperature, or the same maximum of it, would occur under a given geographical line, at equal elevations, whether of a solitary mountain or an extensive cluster; whether of an isolated peak, or a sequestered glen. On the contrary, it seemed obvious that reverberation of heat must produce like effects of concentrated warmth, at the level of the sea, and on the table land of mountains. Accordingly, it does appear, that in the exterior chain of the *Himálaya*, where heat is reflected to it but from one side, the warmth is much less than in the interior cluster, where there is reverberation from all quarters. Capt. G. has repeatedly adverted to these important facts.

He has constantly attended likewise to very interesting questions concerning the geography of plants, and especially regarding the limits of vegetation. In abridging his diary, I have seldom suppressed any circumstance bearing upon these points; but have commonly retained the particulars, at the price, perhaps, of some tediousness and a little repetition. The greatest elevation, at which plants of a notable size are remarked, is 17,000 feet. The utmost limit of vegetation of mosses and lichens must doubtless reach further.

The greatest height attained during this journey was 18,612 feet; viz. at *Mánerang* pass. Next to it is the *Kéúbrang* pass, at 18,312 feet above the sea. Twice, in former journeys, Messrs. Gerard scaled the stupendous altitude of a station on *Pargéúl*, measured twice barometrically 19,411 feet, and now confirmed trigonometrically, not without a surmise of a near approach to 19,500 feet above the level of the sea.

At the elevation of 16,200 feet, on the confines of Chinese Tartary, ammonites were picked up. If not precisely *in situ*, they probably had not come from a remote situation; for the specimens are of ammonites themselves, not *saligráma* stones containing their impressions, and therefore not

likely to have been elsewhere picked up from a religious motive, and accidentally dropped on the spot where they were now found, which was in a region of limestone. Ammonites have been found at a like elevation in the beds of torrents near the *Níti* and *Mána* passes.

A further advance into Chinese Tartary would probably have ascertained the site of these and perhaps of other organic remains; but the travellers were repelled by a guard stationed on the frontier. In two other quarters they met with a similar repulse, from Tartar guards, posted on the frontiers of Chinese Tartary.

I cannot quit the subject without inviting the Society to applaud the persevering exertions of these intrepid travellers in their arduous enterprise. Capt. Gerard and his brother have been neither appalled by danger nor deterred by fatigue; and to the official duties of the survey on which they were employed, else sufficiently laborious, they have superadded a most laudable zeal for the advancement of science in every way for which an opportunity was presented to them, and have evinced exemplary diligence in the prosecution of researches.

I may here be allowed to express regret, that the valley of the *Gandhac* river is yet unexplored. It is in that valley that ammonites are known to abound, and other ancient remains may be looked for. It is probably the route by which the *Dhawalagiri*, or White Mountain of the *Himálaya*, may be approached, and the altitude of apparently the highest mountain, definitively determined. I still entertain the expectation, grounded on measurements taken from remote stations, that its height will be found to be not less than 27,000 feet above the level of the sea.

I have much to observe on the geological notices scattered in Capt. Gerard's diary, and sparingly quoted in the foregoing summary; but I reserve what is to be said on this topic, and on the copious collection of specimens received from him, for a communication to the Geological Society.